



Technical specification for
CONTROL & INSTRUMENTATION
4 X 270 MW BHADRADRI TPP, TELANGANA

SECTION D

REV. NO. 00

DATE : 24.03.2015

APPLICABLE CABLE TYPES

CABLE SIZES FOR 4 X 270 MW BHADRADRI TPS PROJECT JOB NO. 411 (PER UNIT)	
Sl no.	Cable Type
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sqmm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	24P X 0.5 sqmm
	CONTROL CABLE
1	3C X 2.5 sqmm
2	5C X 2.5 sqmm
3	12C X 1.5 sqmm



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APPLICABLE CODES & STANDARDS

4.45.00 Local Instruments , Flow Elements and Control Valves

Required local instruments including gauge boards, etc. and Flow Elements , Control valves shall be provided for safe and efficient operation of the plant. .

4.46.00 Erection Hardware

Standard and good engineering practice of international standard shall be adopted throughout. All materials supplied shall be suitable for tropical, dust laden, humid power plant environment and shall be from reputed manufacture.

4.47.00 C&I Cabling

Instrumentation cables shall be copper, overall screened for binary signals and individual pair and overall screened for analog signals. All cables shall be FRLS type (inner and outer sheath) ,armored, other than short run cables which may be unarmored. Unarmored cables shall run through conduits.

C&I cable type shall also include FO , Prefab , Coaxial , compensating cable , special cable etc

The screen shall be grounded at the remote panel end at control / equipment room only.

5.00.00 CODES AND STANDARDS

The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE , IS etc. Generally, the following latest edition of codes and standards prevailing at the time of award of contract shall be applicable.

1) Temperature Measurement

- a) Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
- b) Temperature Measurement - Thermocouples - ANSI - MC 96.1 - 1982.
- c) Temperature Measurement by electrical resistance thermometers - IS: 2806
- d) Thermometer-element-Platinum resistance - IS: 2848 / DIN 43760.

2) Pressure Measurement

- a) Instrument and apparatus for pressure measurement - ASME PTC 19.2 (1964).
- b) Bourdon tube pressure and vacuum gauges - IS: 3624/1996.

- 3) Flow Measurement
 - a) Instruments and apparatus for flow measurement - ASME PTC 19.5 (1972) Interim supplement, Part-II
 - b) Measurements of fluid flow in closed conduit - BS 1042.
- 4) Electronic Measuring Instruments and Control Hardware
 - a) Automatic null balancing electrical measuring instruments -ANSI C 39.4 (Rev. 1973), IS 9319
 - b) Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 / 1974.
 - c) Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1: ANSI MC 12.1 / 1975.
 - d) Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975) - ISA -S26 (1968).
 - e) Surge withstand capability (SWC) tests - ANSI C 37.90A (1989), IEC-255.4.
 - f) Printed circuit boards - IPC TM-650, IEC 326C.
 - g) General requirements and tests for printed wiring boards - IS-7405 (Part-I)/1973.
 - h) Edge socket connectors - IEC 130-11.
 - i) Requirements and methods of testing of wire wrap terminations--DIN 41611 Part-2.
 - j) Dimensions of attachment plugs and receptacles- ANSI C73-1973.(Supplement ANSI C73a – 1980)
 - k) Direct Acting Electrical Indicating Instruments - IS - 1248 - 1968
- 5) Instrument Switches and Contacts
 - a) Contact Rating - AC services NEMA ICS Part-2 125, A-600
 - b) Contact Rating - DC services NEMA ICS Part-2 125, N-600
- 6) Enclosures
 - a) Enclosures for Industrial Controls and Systems--NEMA ICS-6-110.15 through 110.22
 - b) Racks, panels and associated equipment -EIA: RS-310-B-1983 (ANSI C83.9 - 1972) / IEC 60947 / IEC 60529
 - c) Protection Class for Enclosures , Cabinets Control Panels and Desks - IS 2147 1962

- 7) Apparatus, Enclosures and Installation Practices in Hazardous Area
 - a) Classification of hazardous area - NEMA Article 500, Volume-6, 1978./ NFPA Article 500 , Vol.70-1984
 - b) Electrical Instruments in hazardous dust locations - ISA-RP 12.11.
 - c) Intrinsically safe apparatus - NFPA Article 493 Volume-4 1978.
 - d) Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Article 496 Volume-4, 1982.
- 8) Sampling System
 - a) Stainless Steel material of tubing and valves, for sampling system - ASTM A 269-79 GRT0-316.
 - b) Submerged helical coil heat exchangers for sample coolers -- ASTM D11-98.
 - c) Steam and water sampling ,conditioning and analysis in the power cycle - ASME PTC - 19.11
 - d) Standard methods of sampling system - ASTM D 1066-69
- 9) Annunciators
 - a) Specifications and guides for the use of general-purpose annunciators - ISA RP 18.1.
 - b) Surge withstand capability tests -ANSI C37.90 a -1971 and IEEE Standard 472-1974.
- 10) Interlocks, Protections
 - a) Relays and relay system associated with electric power apparatus - IEEE Standards 3.13.
 - b) Surge withstand capability tests - ANSI C37.90 a - 1971 and IEEE Standard 472-1974.
 - c) General requirements and tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I)/1973.
 - d) Turbine water damage prevention - ASME-TDP-1-1980.
 - e) Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F, 85G.
 - f) Installation and operation of Pulverized fuel system - ANSI / NFPA 8503
 - g) Functional diagramming of Instrument and control systems - SAMA PMS 22.1
 - h) Digital interface for programmable instrumentation - ANSI / IEEE 488

11) Control Valves

- a) Control valve sizing (Incompressible fluids) - ISA-S39.2 / 1972.
- b) Control valve sizing (Compressible fluids) - ISA-S39.4 / 1972.
- c) Control Valve seat leakage – ANSI / FCI 70.2
- d) Face to face dimensions of Control Valves - ANSI B16.10
- e) Control Valve Capacity Test Procedure – ISA – S75.02

12) Process connection Piping and Tubing

- a) Seamless Carbon Steel Pipe - ASTM-A-106.
- b) Forged carbon steel fittings - ASTM-A-105.
- c) Dimensions of fittings - ANSI-B16.11.
- d) Code for pressure piping, welding, hydrostatic testing - ANSI-B 31.1.
- e) Nomenclature for instrument tube fittings - ISA-RP 42.1 / 1982.
- f) Seamless Stainless Steel Tube ASTM A-213 TP 316 / ASTM A-269 TP 316
- g) Seamless Alloy Steel Pipe ASTM A 335 P22
- h) Seamless Stainless Steel Pipe ASTM A-312 TP 316
- i) Forged and Rolled alloy steel pipe flanges , forged fittings , valves and parts ASTM A - 182
- j) Pipe fittings of wrought carbon steel and ally steel - ASTM A - 234
- k) Composition bronze metal castings ASTM B - 62
- l) Seamless copper tube , bright annealed ASTM B- 168
- m) Valves flanged and butt welding ends ANSI B 16.34

13) Cables

- a) Thermocouple extension wires / cables - ANSI MC96.1.
- b) Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy-IPCEA S-61-402
- c) Guide for design and installation of cable system in power generating station (insulation, jacket materials) -IEEE Standard 422.
- d) Requirements of vertical tray flame test - IEEE 383
- e) Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B33.



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KKS PHILOSOPHY

**KKS NUMBERING PHILOSOPHY**

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A	A	Y	Y	B	B	B
---	---	---	---	---	---	---	---	---	---

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

**ANNEXURE-1****List of System / Sub-System Codes used in Power Plant:**

- 1) Compressed air system : QEA, QEB, QEC, QED

ANNEXURE-2**Standard Equipment Codes:**

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY	
4X270MW BHADRADRI TPP, TELANGANA		

CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i)

Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:

a)

Main Steam (Left) and Main Steam (Right)

b)

BFP – A/B/C

c)

ID Fan – A/B, FD Fan A/B, AH – A/B

ii)

For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii)

If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i)

Valves and Dampers

Equipment Code – AA

		<u>N1</u>	<u>N2 N3</u>
Motorised (on/off duty)	-	0	01 to 50
Motorised (inching duty)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (thyrestor Control)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99



DOCUMENT TITLE

KKS NUMBERING PHILOSOPHY

4X270MW BHADRADRI TPP, TELANGANA

NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99

ii) Field Instruments

Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			

Example of Numerical Key Usage:

In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.

4 X 270MW BHADRADRI TPS AT MANUGURU

SECTION-II

(STANDARD TECHNICAL SPECIFICATIONS)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION-IIA
(FORMAT FOR O& M MANUAL)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

Check List for Operation & Maintenance Manual

Project name:

Project number:

Package Name:

Sl.no. & Sections	Description	Yes	No	Not Applicable	Remarks
1.	Cover page				
1.1	Project Name				
1.2	Customer Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX email address				
1.5	Name and sign of prepared by , checked by & approved by				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	Transportation and handling at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the				

	equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				

6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION - IIB

(SITE STORAGE AND PRESERVATION MANUAL)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

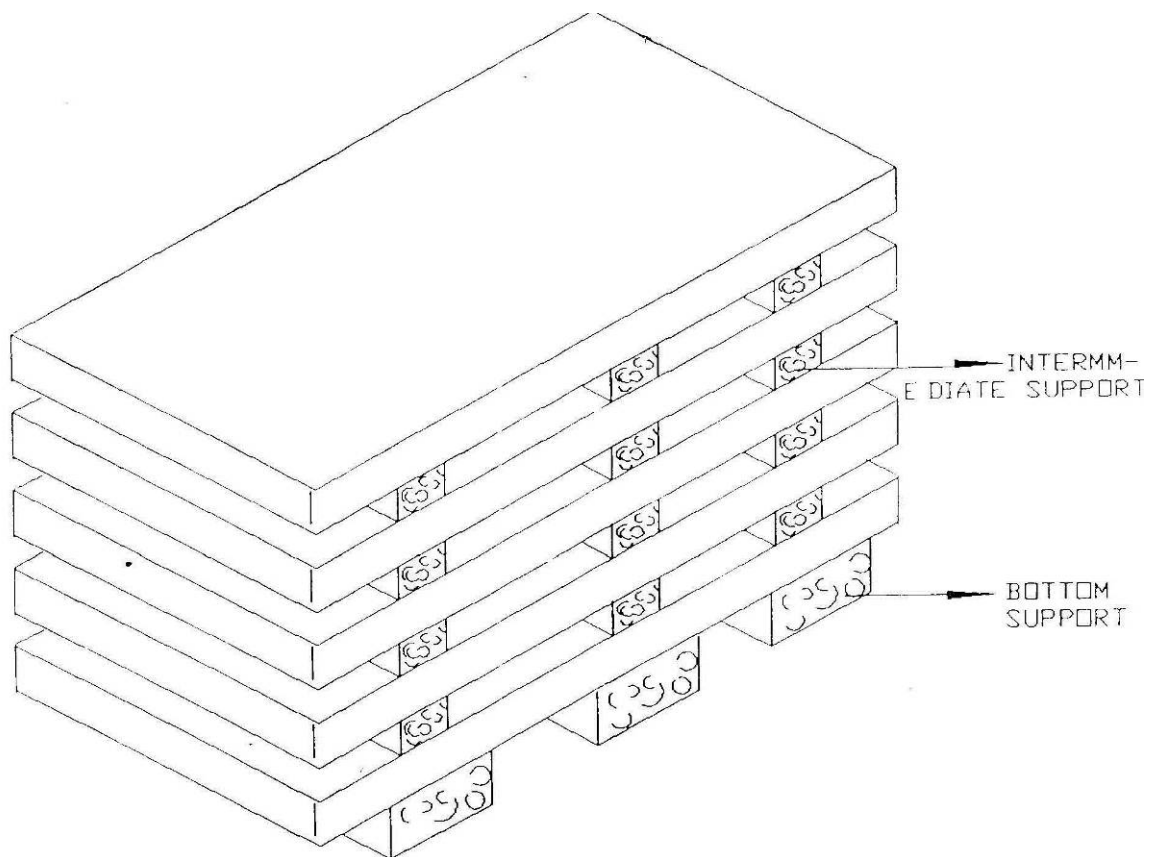


Figure – 1 – PLATE STACKING ARRANGEMENT

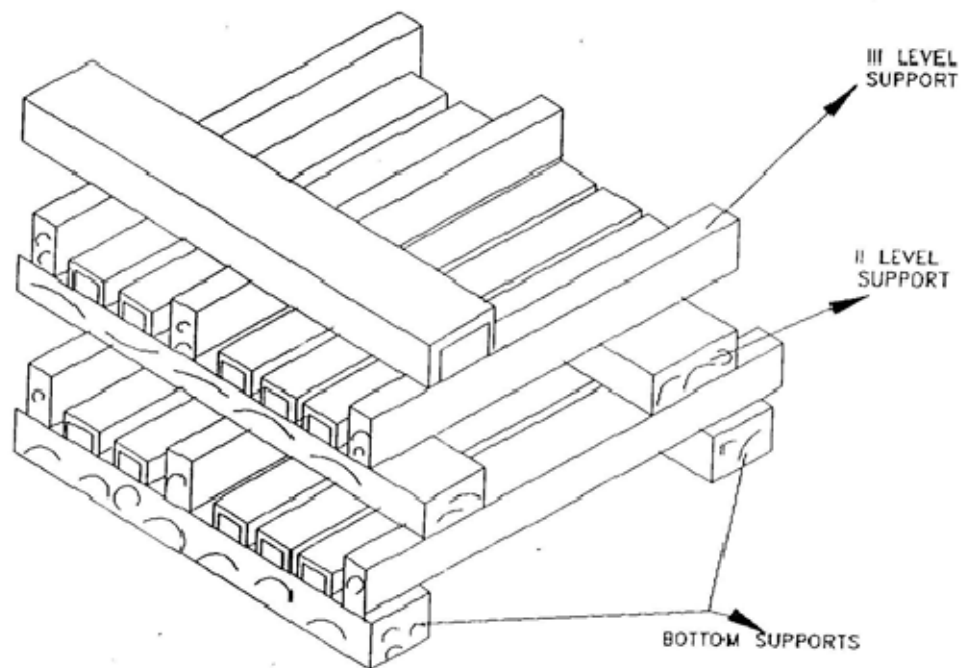


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

COMPRESSED AIR SYSTEM

SECTION - III

DOCUMENTS TO BE SUBMITTED BY BIDDER



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

PPEI,



TECHNICAL SPECIFICATION FOR
COMPRESSED AIR SYSTEM
4x270MW BHADRADRI TPS

SPECIFICATION NO. PE-TS-411-555-A001

SECTION IIIA

REV – 00

DATE - 04.04.17

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM

SECTION-IIIA



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA



**TECHNICAL SPECIFICATION FOR
COMPRESSED AIR SYSTEM
4x270MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-555-A001

SECTION IIIA

REV – 00

DATE - 04.04.17

LIST OF DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit following drawings / documents along with their bid:

- a. Copy of pre-bid clarification, if any, duly signed and stamped.
- b. Copy of electrical scope between BHEL & vendor dully signed and stamped.
- c. Electrical equipment specification for Compressed air system duly signed and stamped.
- d. Electrical load list dully filled
- e. Deviation schedule with reference to specific clauses of the specification along with reason for such deviation.
- f. Copy of unpriced price bid indicating “QUOTED / NOT QUOTED” / “NOT APPLICABLE” as the case may be.
- g. Copy of drwg/doc schedule dully signed and stamped.
- h. Compliance cum confirmation certificate

NOTES:

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF THE ABOVE DOCUMENTS.

DOCUMENTS OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINIGLY WILL NOT BE CONSIDRED FOR BID EVALUATION.



TITLE:

**TECHNICAL SPECIFICATION
4X270 MW BHADRADRI TPS
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

SPEC. NO.: PE-TS-411-555-A001

SECTION: IIIB

REV. NO. 0 DATE

SHEET 1 OF 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment as applicable, shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



TITLE:

**TECHNICAL SPECIFICATION
4X270 MW BHADRADRI TPS
COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

SPEC. NO.: PE-TS-411-555-A001

SECTION: IIIB

REV. NO. 0 DATE

SHEET 2 OF 2

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL



TITLE

**STANDARD TECHNICAL SPECIFICATION FOR
CAS**

SPECIFICATION NO. PE-TS-STD -555-A001

SECTION IIIC

REV 00

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

DEVIATION SHEET (COST OF WITHDRAWAL)



PROJECT:- 4 x 270MW BHADRADRI TPS, MANUGURU

PACKAGE:- COMPRESSED AIR SYSTEM

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE	
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NOTES:

- For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
- All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
- Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
- Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
- Bidder shall furnish price copy of above format along with price bid.
- The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
- Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
- For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
- Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
- All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
- Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
- In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

COMPRESSED AIR SYSTEM

SECTION - III E

ELECTRIC LOAD DATA OF CAS



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTRO L CODE	REMARKS	LOAD No.	
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOS					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
INSTRUMENT AIR COMPRESSORS	300 KW		S	4	1	B	U	N	C		Compressor House								
SERVICE AIR COMPRESSORS	300 KW		S	4	0	B	U	N	C		Compressor House								
INSTRUMENT AIR COMPRESSOR FAN MOTOR (IF REQUIRED SEPARATE POWER SUPPLY)	2.2 KW		S	4	1	D	U	N	C		Compressor House								
SERVICE AIR COMPRESSOR FAN MOTOR (IF REQUIRED SEPARATE POWER SUPPLY)	2.2 KW		S	4	0	D	U	N	C		Compressor House								
INSTRUMENT AIR COMPRESSOR PANEL	3 KW		S	4	1	E	S	N	C		Compressor House								
SERVICE AIR COMPRESSOR PANEL	3 KW		S	4	0	E	S	N	C		Compressor House								
INSTRUMENT AIR COMPRESSORS MOTOR SPACE HEATER	0.15 KW		S	4	1	E	D	N	I		Compressor House								
SERVICE AIR COMPRESSORS MOTOR SPACE HEATER	0.15 KW		S	4	0	E	D	N	I		Compressor House								
AIR DRYER PLANT PANEL	2 KW		S	4	1	D	S	N	C		Compressor House								
AIR DRYER PLANT MOTOR	10 KW		S	4	1	D	U	N	C		Compressor House								
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																			
	LOAD DATA (ELECTRICAL)	JOB NO.		411							ORIGINATING AGENCY			PEM (ELECTRICAL)					
		PROJECT TITLE		4X270MW BHADRADRI TPP							NAME				DATA FILLED UP ON				
		SYSTEM		COMPRESSED AIR SYSTEM							SIGN.				DATA ENTERED ON				
		DEPTT. / SECTION		MAX							SHEET 1 OF 2		REV. 00		DE'S SIGN. & DATE		page 318 of 322		

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTRO L CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AUTO DRAIN TRAP	0.02 KW		S	14	-	E	S	N	I		9 nos. at Compressor House, 1 no each near TG hall of each unit, 1 no near DM plant							
Any other power supply as required by bidder	To be filled by bidder																	
Note: - Bidder to confirm that the system provided by them would be catered by the above loads considered by BHEL. In case there is any variation, the same should be clearly stated in the technical offer. No changes would be admissible during detailed engineering stage. - Bidder to note that for the system being supplied by them, only the above loads will be provided. In case any other load is required, the same would be derived / multiplied by bidder on their own from these feeders only. - Any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.																		
NOTES: - COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER - ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)																		
LOAD DATA (ELECTRICAL)	JOB NO.		411				ORIGINATING AGENCY				PEM (ELECTRICAL)							
	PROJECT TITLE		4X270MW BHADRADRI TPP				NAME				DATA FILLED UP ON							
	SYSTEM		COMPRESSED AIR SYSTEM				SIGN.				DATA ENTERED ON							
	DEPTT. / SECTION		MAX				SHEET 2 OF 2		REV. 00		DE'S SIGN. & DATE		page 319 of 322					

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

COMPRESSED AIR SYSTEM

SECTION - IIIF

SUGGESTIVE PRICE BBU



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA

SUGGESTED BBU OF CAS		Doc No:	PE-PF-411-555-A001			
		Rev No:	0			
		Date of issue	01.04.2017			
NAME OF PROJECT:		4 X 270 MW BHADRADRI TPS				
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM				
TECHNICAL SPECIFICATION:		PE-TS-411-555-A001				
S. No.	DESCRIPTION	UNIT	QTY	Total price (Ex-Works)	REMARKS	
1	2	3	4	5		
	BREAK-UP OF SUPPLY PRICES GIVEN IN 2.1 OF MAIN SHEET.					
2.1.0	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for Supply part comprising of design (i.e.preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables alongwith spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, preperation of layout drawings 3D (as applicable) for the total scope defined as per BHEL NIT & tender technical specification as specified above, amendment & agreements till placement of order.	Lot	1			
	Break up prices for items covered in clause 2.1 above.					
2.1.1	Instrument Air Compressor (oil free Screw) Each of 30 NM3/Minute capacity at 8.5 kg/cm2 (g) with accessories, Suction filter and silencer, Inter Cooler, After Cooler with moisture separators, automatic drain traps, instruments, Control panel etc. (Electric motor to drive the compressor is excluded from bidders scope).	Nos.	5		Col. 5 of this clause shall be within 26-28 % of total price at Col 5 of Clause 2.1.0.	
2.1.2	Air Dryer (HOC Type) Air Drying Plant of 30 NM3/min and to match instrument air compressor with all instruments and controls including Electronic Dew point meter as specified.	Nos.	5		Col. 5 of this clause shall be within 17-19 % of total price at Col 5 of Clause 2.1.0.	
2.1.3	Service Air Compressor (oil free Screw) Each of 30 NM3/Minute capacity at 8.5 kg/cm2 (g) with accessories, Suction filter and silencer, Inter Cooler, After Cooler with moisture separators, automatic drain traps, instruments, Control panel etc. (Electric motor to drive the compressor is excluded from bidders scope)	Nos.	4		Col. 5 of this clause shall be within 21-23 % of total price at Col 5 of Clause 2.1.0.	
2.1.4	Compressor house outdoor Air recievers Air receiver of 10M3, near compressor house with each having Pressure gauges, Temperature gauges, Relief valve, Drain connection with zero purge type automatic trap stations and other accessories as specified.	Nos.	9		Col. 5 of this clause shall be within 6 - 8 % of total price at Col 5 of Clause 2.1.0.	
2.1.5	Unit Air recievers Air receiver of 10M3, in BC bay of TG Hall with each having Pressure gauges, Temperature gauges, Relief valve, Drain connection with zero purge type automatic trap stations and other accessories as specified.	Nos.	4			
2.1.6	DM Plant Air reciever Air receiver of 2M3, near DM plant with each having Pressure gauges, Temperature gauges, Relief valve, Drain connection with zero purge type automatic trap stations and other accessories as specified.	Nos.	1		Col. 5 of this clause shall be within 1 % of total price at Col 5 of Clause 2.1.0.	
2.1.7	Pipes & fittings Inter connecting cooling water, compressed air piping & Drain piping up to the nearest common drain point outside compressor house as specified including fittings and valves, etc. for complete compressed air system.	Lot	1		Col. 5 of this clause shall be within 8 - 10 % of total price at Col 5 of Clause 2.1.0.	
2.1.8	Field instruments as specified including temperature scanners, Flow meter, Flow transmitter & other instruments as specified.	Lot	1		Col. 5 of this clause shall be within 5 - 7 % of total price at Col 5 of Clause 2.1.0.	
2.1.9	Cable, Cable lugs, glands, junction box, communication box etc for Compressed Air System equipment as required.	Lot	1		Col. 5 of this clause shall be within 1 - 3 % of total price at Col 5 of Clause 2.1.0.	
2.1.10	Total lump sum prices for Start-Up & commissioning spares and maintenance tools & tackles.	Lot	1		Col. 5 of this clause shall be within 1 - 3 % of total price at Col 5 of Clause 2.1.0.	

2.1.11	Additional items (4 nos. compressor microprocessor controller, 7 nos. communication box and 5 set of instruments within compressor & dryer skid)	Lot	1		Col. 5 of this clause shall be within 5 - 7 % of total price at Col 5 of Clause 2.1.0.
3	TOTAL SUPPLY PRICE (SUM OF 2.1.1 TO 2.1.11) [should match with total of S.n 2.1.0 at Col.5]	Lot	1		Col. 5 of this clause shall be within 100 % of total price at Col 5 of Clause 2.1.0.
Note: 1.) Percentage of individual item shall be maintained by successful bidder during submission of BBU for CAS package during detailed engineering stage.					